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Testing Equipment

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1. High-power and medium-power transmitter tubes, as well as medium-power special tubes, were tested with special equipment while low-power special tubes were tested on test benches.

2. Old testing equipment for electronic tubes was built in 1945 and 1946 and was used for testing water-cooled high-power transmitter tubes (CAT 17C, CAT 14C, CAT 201, CAT 20, CAT 12A, CAT 10, CAT 9, CAT 6K, CAT 6, CAT 3 and CAM 3) as well as for testing medium-power transmitter and medium-power rectifier tubes (ACT 9, ACM 1S, ACM 3, ACR 2, ACS 2, MT 9, MT 9A, MT 9F, MT 9L, MT 12, MT 12A, MT 14, DEM 2, DET 2, DET 3, MR 4, MR 6, and MR 7A). This equipment consisted of:

   a. Water coolers. There were four water coolers of different sizes. The largest was for CAT 17C and CAT 14C tubes. The next smaller size was for CAT 201, CAT 20, CAT 12A and CAT 10 tubes. The next smaller was for CAT 9 tubes, and the smallest size was for CAT 6, CAT 6K, CAT 3 and CAM 3 tubes. These coolers were cylindrical iron vessels supported by porcelain insulators for high voltage. The tube was set with the anode, fastened by screws, extending into the vessel. The tubing for the water for the cooler was connected with rubber hoses with two disc-shaped water resistors, 1. one for water inlet, the other for outlet.

   b. Iron supports into which were set medium-power transmitter and rectifier tubes. These supports were fork-shaped for the ACT tubes and ring-shaped for the MT, MR, DET 2, DET 3 and DEM 2 tubes. The supports on the base were equipped with copper rings with openings through which the air was forced.

   c. Tubing for air inlet equipped with an air monitor.

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d. Sources for heating tubes:

(1) Single-phase transformer, about 2½ KVA, 220 volts/25 volts. An adjustable auto-transformer connected on the primary winding regulated the heater voltage (from o to 25 volts). This transformer was used for small-size high-power transmitter tubes as well as medium-power transmitter and rectifier tubes.

(2) Dynamo for direct current (for description see paragraph 5). This dynamo was located in the Main Production Building on the first floor 2. and was controlled from the old testing-equipment installation. This dynamo was used for the largest types of high-power transmitter tubes.

e. Main (large) anode rectifier equipped with CAR 6 tubes (for description see paragraph 4 below). This rectifier was used for high-power transmitter tubes and was controlled from the old testing-equipment installation.

f. Small anode rectifier equipped with six GU 14 mercury rectifiers. It was usable up to nine kilovolts and up to one ampere. This rectifier consisted of a three-phase air transformer (about 5 KVA, 3 x 380 volts/10,000 volts, regulated with a booster on the primary winding), an oil inductance, and an oil condensor. This rectifier served medium-power transmitter and rectifier tubes.

g. Grid rectifier for negative grid bias voltage down to -2,000 volts. This consisted of a one-phase transformer (about 0.5 KVA, 220 volts/3,000 volts with adjustable auto-transformer connected to the primary winding for regulating the grid bias voltage), two GU 14 mercury rectifiers, an air inductance, and a small oil condensor.

h. Oscillator. It had two large induction coils. One, about 50 cm. in diameter and about 65 cm. long, was for the oscillator anode circuit and consisted of a copper wire band 1.8 mm. thick, about 35 mm. wide. The other coil was for the grid circuit and consisted of a copper wire 5 mm. in diameter. The coil was 25 cm. in diameter and 35 cm. long. Both coils rested on insulators. In addition to the induction coils, the oscillator had oil tuning condensors -- one for the anode circuit, another for the grid circuit, and another of fixed capacity. In addition, there were several ceramic condensors of fixed capacity. The oscillator also had resistors for the grid circuit which were constructed of meshed resistor wire and asbestos cord; the resistors were rectangularly shaped and set into a "micalex" insulating frame. These resistors were for high-power transmitter tubes. In addition there were ceramic resistors for medium-power transmitter tubes.

i. Dummy antenna which consisted of a resistor wire wound around four mica plates, 25 mm. wide and 500 mm. long. The plates were placed in glass tubes through which cooling water was conducted. (The antenna was called a dummy because the energy from the oscillator was not emitted into space but was absorbed by the resistor wire, and the heat was conducted away by the water.)

j. Electronic oscillograph for measuring cathode emission (for determining the exact heating voltage of the tube at a given rate of cathode emission). This oscillograph was mainly used for high-power transmitter tubes.

k. Various oil and air switches and circuit-breakers both for net voltage and high voltage (up to 30,000 volts); push-switches; electric signal bulbs; and circuit-breakers at the entrances to the equipment for automatic disconnecting of the high-voltage current.

l. Relay for disconnecting the anode circuit in case of ionic discharges inside the tube being tested.

m. Various standard electric measuring instruments.

n. Various conductors for high-voltage and net-voltage current, fuses, etc.

o. Iron framework, iron-sheeted, where the equipment was placed. The old testing equipment was located in the Main Production Building on the second floor. 3. Only one tube at a time could be tested with the equipment.

3. New testing equipment for high-power transmitter tubes and for medium-power transmitter and medium-power rectifier tubes was under construction in the plant from the beginning of 1952. The construction was half finished during the spring of 1953 and [redacted] it was finished 25X1
by the end of 1953. This new testing equipment consisted of the following:

a. Equipment for testing the medium-power transmitter and medium-power rectifier tubes listed above /paragraph 2/. This equipment consisted of:

(1) Two copper stands where the tubes being tested were set. The stands had a cooling ring with openings through which the air was forced. The compressed air was conducted to the stand through a rubber hose.

(2) Two single-phase heating transformers, about 1 KVA and 220 volts/30 volts each, with a revolving adjustable auto-transformer on the primary winding.

(3) Two anode rectifiers up to about 10 kilovolts and one ampere each. They were similar to the small anode rectifier described above /paragraph 2. f./, [redacted] they had 25X1
no booster, but a three-phase adjustable column auto-transformer.

(4) Two rectifiers for grid bias voltage down to about -1,000 volts. (The rectifiers were similar to the description under paragraph 1. g.)

(5) Oscillator with a dummy antenna.

(6) Iron framework which formed the front part of the testing equipment. Two stands for testing the tubes were placed on the framework with a control panel between. The heating transformers were placed in the lower part of the framework and there was space for the operator to sit in front of the panel. Behind the framework were the parts mentioned above /paragraph 3. a. (3) - (5)/ which were surrounded by meshed wire with an entry door equipped with automatic breakers for disconnecting the high voltage.

Further, the equipment consisted of the devices as described above, /paragraph 2. k. through n./. All this equipment was constructed during the second half of 1952 and at the end of the year it was set in operation. Two tubes could be tested with this equipment at the same time except when testing the tube on oscillation. The equipment was located in the Main Production Building on the first floor. 4.

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b. Equipment for testing water-cooled high-power transmitter tubes with external anode (CAT 9, CAT 6, CAT 6K, CAM 3 and CAT 3) was constructed during 1952 and 1953. The iron framework was constructed during the second half of 1952; the individual parts of the equipment were under construction during 1953.

This equipment was to consist of:

(1) Two testing positions with two water coolers each. One water cooler was to be used for CAT 9 tubes and the other for the other types of tubes. The water tubing was equipped with two water resistors and one monitor.

(2) Tubing for compressed air with rubber hoses and an air monitor.

(3) Two single-phase heating transformers about 3 KVA, 220 volts/30 volts, with adjustable auto-transformer on the primary winding.

(4) One or two grid rectifiers with grid bias voltage down to about -2,000 volts.

(5) Oscillator with a dummy antenna.

In addition, equipment similar to that described above [paragraph 1. k. through n.].

It was planned to use main anode rectifier equipped with CAR 6 tubes [paragraph 5] as well as main anode rectifier with GT 15 tubes [paragraph 4 below]. Further, it was planned to test two tubes at one time, which would require two grid rectifiers [paragraph 3. b. (4)]. Only one tube could be tested on oscillation at one time.

This equipment was located in the Main Production Building on the first floor. 5.

c. Equipment for testing the largest water-cooled high-power transmitter tubes with external anode (CAT 14C, CAT 17C, CAT 201, CAT 20, CAT 12A, CAT 10). The iron framework had been under construction since the first half of 1953, and the construction of individual parts was in preparation during the same time. This equipment was to consist of:

(1) Two testing positions, each with one or two water coolers and a water conducting system, two water resistors, and one water monitor.

(2) Tubing for compressed air for the cooling rings of the tubes and a water monitor.

(3) One or two rectifiers for grid bias voltage down to about -2,000 volts.

(4) Oscillator with dummy antenna which would be similar to the oscillator described above [paragraph 2. h.].

(5) Parts similar to those described above [paragraph 1. k. - n.].

(6) Iron framework with panel. This framework was different in design from that described above [paragraph 3. a. (6)]. It had two iron doors with glass windows for watching the tubes tested and for entry to the testing positions and one door for entry to the equipment itself.

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(7) It was planned to use the direct-current dynamo /paragraph 6./ for heating the tubes. However, this dynamo could heat only one tube at a time, therefore, it was the intention to buy or manufacture a heating transformer with inductance in the plant, similar to the one located in the Main Production Building, second floor. 6.

(8) It was planned to use the main anode rectifier with GT 15 tubes /paragraph 6./ as well as the main anode rectifier with CAR 6 tubes /paragraph 4./ as sources for anode voltage.

With two sources of heating, two anode rectifiers and two rectifiers for grid bias voltage, two tubes could be tested at the same time except for oscillation. This equipment was to be located in the Main Production Building, first floor 7., and was to be operated only at night. 8.

Only one oscillograph, which was to be portable, was to be used for the equipment mentioned above /paragraph 2 a., b. and c./. Details of use had not been determined.

4. Main (large) anode rectifier with GT 15 tubes was in initial construction during the first half of 1953. It was to be of 25 kilovolts and up to 8 or 10 amperes and was to be equipped with six GT 15 tubes. The main transformer for the rectifier, 250 KVA, was purchased at the beginning of 1952, probably from the Janka Firm. This rectifier was to be placed in the Main Production Building, first floor, 9. and was to be used with the production equipment above /paragraph 3 b. and c./. In addition, all the GT 15 tubes produced in the plant were to be tested in this rectifier.

5. Main (large) anode rectifier with CAR 6 tubes had the following principal parts:

a. Three-phase oil transformer, about 150 KVA, 3 x 6 kilovolts/30 kilovolts, used as main transformer of the rectifier.

b. Oil inductance.

c. Oil condensor, with a voltage up to 30 or 50 kilovolts.

d. Special heating transformer, three-phase, oil, about 15 KVA, 3 x 380 volts/28 volts. (The secondary winding was specially insulated for high voltage, up to 30 kilovolts, which came from the oil transformer /5. a./ because the cathode of the CAR 6 tube was connected with the main transformer so that the high voltage passed from the main transformer to the winding of the heating transformer. The porcelain terminals of the transformer were usable for a voltage up to 30 kilovolts.) The transformer was mounted on porcelain insulators.

e. Three CAR 6 rectifier tubes arranged in water coolers with water monitor.

f. Main oil switch, three-pole, for high voltage (3 x 6 kilovolts) to control the oil transformer /5. a./. This switch was controlled by another switch which was operated by an electric motor.

g. Three air inductances for high voltage, one for each phase (the inductance was an insulated copper band spirally placed in the insulator).

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h. Booster, three-phase, 20 KVA, 3 x 380 volts/25 volts, to regulate the voltage of the primary winding of the heating transformer /5. d./. The booster was turned by a small electric motor with screw transmission.

i. Panel with measuring instruments and various switches.

The voltage of this anode rectifier was regulated by the heating of the cathode of the CAR 6 tubes. This anode rectifier was built during 1945 and 1946 and was located in the Main Production Building on the first floor. [10].

6. Direct-current dynamo for heating high-power transmitter tubes of largest sizes operated up to 35 volts and 500 amperes and was driven by a three-phase electric motor with an output of about 20 kilowatts, which was connected to the dynamo by fixed clutch. The electric motor was switched on by an oil switch. The voltage of the dynamo was regulated by a magnet. The dynamo was built in the plant during 1945 and 1946 and was located in the Main Production Building on the first floor. [11]

7. Equipment for testing air-cooled high-power transmitter tubes with horizontal air cooling was built in the plant, in the department for transmitter production, in the first half of 1950. Since the beginning of 1952 it has been located on the first floor of the Main Production Building. [12]. The equipment consisted of:

a. Insulator to support the cooler (channel ducting system) in which the tube was set. [13]. The insulator was a ceramic and porcelain tube; external diameter 36 cm., internal diameter 26 cm., height 55 cm.; the surface was moderately curved. The bottom of the insulator was set into tubing which served as an exhaust for air.

b. Cooler, channel ducting system. There were three sizes of coolers. The smallest one, for ACT 14 tubes, had four or five channels, was 18/10 cm. in diameter, height 30 cm. This cooler was built in the first half of 1953. The medium size, five channels, was for ACT 16 tubes. [13]. The largest, five or six channels, was 28/18 cm. in diameter, 45 cm. high, and was used for ACT 201. The coolers were of welded iron sheeting. The coolers were interchangeable but there was only one insulator.

c. Two ventilators connected to one exhaust tubing. Each ventilator was driven by an electric motor. Both ventilators were used when ACT 201 tubes were tested and one ventilator was used when ACT 16 or ACT 14 tubes were tested. A thermometer for measuring the temperature of the warm air and a liquid barometer for measuring pressure were arranged in the exhaust tubing.

d. Grid bias voltage rectifier down to -2,000 volts.

e. Short-wave oscillator with water-cooled dummy antenna.

The insulator, cooler, and oscillator were arranged in an iron closet to which a panel with measuring instruments was connected. The rectifier for grid bias voltage was set up on the rear side of the panel. (The panel and ventilators were built during 1952.)

f. Direct-current dynamo mentioned above /paragraph 6/ was used for heating the cathode of the tested tube.

g. The main anode rectifier mentioned above /paragraph 5/ was used as a source for anode voltage.

Only one tube could be tested at one time.

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8. Equipment for testing mercury rectifiers (thyratrons), other than GU 14 and GU 11, consisted of:

   a. Testing position: two sockets into which the prongs of the tube were placed; a sleeve socket into which the testing triode was screwed; a socket for RHT 1; two copper leads for anode voltage; and two copper leads for grid voltage.

   b. Heating transformer, 0.3 KVA, 220 volts/5 volts.

   c. Small heating transformer, 220 volts/2 volts (for heating cathode of RHT 1).

   d. The transformer for grid voltage.

   e. Variable resistors for anode current regulation.

   f. Oil transformer, single-phase, 220 volts/25 kilovolts, for testing thyratrons on high voltage.

   g. Relay to control the switch for oil transformer /8. f./.

   h. Main net switch to connect the 3 x 380 volts electric net to the equipment. Oil switch to connect the net voltage to the transformer /8. f./. Turnable switch, one pole, up to about 25 amperes, to connect the net voltage (220 volts) to the tested tubes.

This equipment was located in the Main Production Building on the second floor.[14] It was built during 1946. Until the beginning of 1951, all the mercury rectifiers, not only thyratrons, were tested by this equipment. (Until 1949, the thyratrons were tested as diodes. Only after 1949 were thyratrons tested as such.) The equipment was in bad shape and was not fit for the testing. Two tubes were tested at the same time, one as a diode, the other as thyratron.

9. Equipment for testing GU 14 and GU 11 mercury rectifiers consisted of:

   a. Testing position: six sleeve sockets (Edison screw) for GU 14; six sockets for GU 11; (the prongs of the tubes were placed into the sockets); and six copper leads (flat cable) for anode voltage.

   b. Heating transformer, about 0.5 KVA, 220 volts/2.5 volts and 5 volts, for heating cathodes of the tubes being tested.

   c. Anode rectifier with GT 15 (used as thyratron) with variable voltage from 0 up to 20 kilovolts.

   d. Resistors, six of 1.5 amperes each, for GU 14 tubes, and six of 2.5 amperes each, for GU 11 tubes.

   e. Various switches for various purposes and measuring instruments.

   f. Iron framework, partially sheeted and mesh-covered, to support the equipment.

The equipment was built in the first quarter of 1951 and was located on the second floor of the Main Production Building.[15] This equipment was not adequate; the anode rectifier was especially weak, so that a maximum of only five units of GU 11 could be tested instead of the six units originally intended. (All six units of the GU 14 type were tested.)

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10. The following test benches were used for testing low-power special electronic tubes:

a. Old test bench. This was manufactured in 1945 and 1946 and was located on the second floor of the Main Production Building. 16. This bench, badly worn, consisted of:

(1) Small heating transformer, 0.2 KVA, 220 volts/25 volts, with an adjustable auto-transformer.

(2) Rectifier for grid bias voltage.

(3) Rectifier regulated by an adjustable auto-transformer, from 0 up to 1,000 volts and up to 200 m A., which was used for voltage of the second grid, as well as for anode voltage with DET 5, RHT 1, and RHT 2. (It was used for triodes with anode voltage below 1,000 volts.)

(4) Rectifier regulated by an adjustable auto-transformer from 0 up to 3,000 volts and up to about 300 m A, which was used for anode voltage.

(5) Panel with oil switch for rectifier /9. a. (4)./ and with air switches for other current sources.

(6) Testing space with: sleeve socket for RD 200/3.5; PT 6B and DET 11; socket (so-called "A") for DET 5; socket (A) for CU 6; K8A socket ("octal socket"); and P socket.

All the sockets mentioned above were part of the test bench, a Pertinax desk with laboratory measuring instruments. Each current source had one voltmeter and one ammeter. All the special low-power electronic tubes could be tested on this equipment. Only one electronic tube was tested at a time.

b. New test bench. This was manufactured in the plant during 1952 and located on the second floor of the Main Production Building. 16. This equipment was similar to the old test bench mentioned above, but the current sources had a steady voltage regulated by a rheostat and I believe that there were always two units of each source of current which would permit testing two tubes at the same time. The sources of current had about the same output as those of the old test bench, only the rectifier for anode voltage was stronger. It was usable up to 400 m A and up to 3,500 volts. This new test bench was of a more modern design than the old one. This equipment was located on the second floor of the Main Production Building. 16.

11. The testing equipment for RHT 1 and RHT 2 was built in the plant at the end of 1951 and consisted of:

a. Small heating transformer, 220 volts/3 volts with a rheostat.

b. Small anode rectifier, 200 volts, up to 0.4 amperes, equipped with two CU 6 tubes.

c. Switch to connect anode current to the ammeter.

d. Watt meter for heater voltage and ammeter for anode current.

e. Sheeted-iron framework.

The equipment had about 12 testing positions (K8A sockets). The equipment was 45 cm. x 30 cm. x 30 cm. in size and was portable.

12. Short-wave diathermic apparatus was built by Chirana, National Enterprise, in Sezemice near Pardubice and bore the trademark Ultraendotherm. The equipment had an output of about 400 watts and was used for testing RD 200/3.5. This apparatus was located on the second floor of the Main Production Building. 17.

Testing Procedure

13. Before being tested as described below, each tube of whatever kind was tested by an inductor on rough vacuum for safety reasons.

14. Testing of all transmitter tubes was as follows:

a. First the tube was set into the testing position, that is, the water-cooled tubes were set into the water cooler, the forced-air-cooled tubes were set into the channel ducting system, and the natural-air-cooled tubes into the testing stand. The heater leads, anode leads, and the grid lead were connected to the tube. Then the coolers and monitors were set into operation.

b. The cathode was gradually heated from zero up to the prescribed voltage. Then the amount of heater current was checked.

c. In order to check the anode dissipation, the source of the rectifier for the grid bias voltage was set into operation and then the necessary grid bias voltage was adjusted. The anode rectifier was set into operation and the anode voltage was applied to the anode while a microampere meter showing grid bias current indicated changes in vacuum. The anode voltage and the anode current were gradually raised up to the prescribed maximum while the vacuum was being checked (the anode current was controlled by grid bias voltage). The tube was submitted to maximum anode dissipation (that is, maximum voltage and maximum current) for one-quarter to one-half hour (the exact time depending on the kind of tube and the quality of vacuum). While being submitted to anode dissipation, the vacuum was gradually improved. At the end of the testing the grid bias voltage and the grid bias current were checked at a given anode voltage and anode current.

d. Testing of oscillation was usually performed on oscillator tubes only. First, the envelope was covered with tissue paper which served as an indicator for hot spots. 18. The tube was connected to the oscillator and to the source of anode voltage. The voltage and the current were gradually raised until they reached the prescribed maximum, at which the tube was oscillated for one-half hour. If no hot spots appeared and if the tube oscillated without any defection for the required time, the test was considered to have fulfilled the requirements.

e. The test mentioned above [14. b.] was repeated with the slight modification that the anode voltage and current were raised to the prescribed maximum in a shorter period of time. This test was repeated only with those tubes which were tested on oscillation.

f. "Characteristics" of the tube, i.e., the anode current (I_a), the anode voltage (E_a), and the grid bias voltage (E_g) were checked at six different corresponding values. From these values the amplifying factor (μ) and the internal resistance (R_i) were determined.

g. The emission of the cathode was checked by means of an electronic oscillograph. The corresponding heating voltage, accurate to 0.1 volt, was checked for the prescribed cathode emission.

h. In addition, the following testing procedures were applied to the largest-sized transmitter tubes (CAT 17C, CAT 14C, CAT 201, CAT 20, CAT 12A, and CAT 10):

(1) The heater current (I_f) was checked at about the last 10 values of the heater voltage (E_f). From the products of I_f and E_f the corresponding W_f's of the cathode were determined. ($I_f \times E_f = W_f$)

(2) The corresponding anode current (I_a) was checked for the individual values of heater voltage. (The anode current equaled the emission of the cathode.) Up to 20 amperes, the anode current was checked directly at the anode voltage of 1,500 volts. Above 20 amperes, the anode current was checked indirectly by means of an electronic oscillograph, at the anode voltage of 2,000 volts.

(3) The emission of the cathode was indirectly checked by the equipment before the procedure described above [paragraph 14. g.]. (For a given anode voltage and anode current, the corresponding heater voltage was checked. This gave the value of the emission.)

(4) The grid bias voltage (E_g), the anode voltage (E_a) and anode current (I_a) were checked for 20 different corresponding values. From the 20 various amplifying factors thus determined, the average amplifying factor was determined. From the 20 various internal resistances, the average internal resistance was also determined.

5. Testing of vacuum rectifier tubes varied according to type.

a. Medium rectifier tubes (MR types and ACS 2) were tested as follows:

(1) Cathode heating was similar to that described above [14. b.].

(2) The tube was submitted to anode dissipation at the prescribed anode current and anode voltage, while the heating voltage was checked about five times, always at 15-minute intervals. The checked values of the heating voltage and the differences between them showed the quality of vacuum and the emission value of the cathode.

(3) Three different corresponding values of anode voltage and anode current were checked, and from the resulting differences the two values of internal resistance were determined, from which the average internal resistance was determined.

b. High-power rectifier tubes with external anode (CAR 6, CAR 4, and CAR 2) were tested in the following way:

(1) The heating current (I_f) was checked for heating voltages (E_f) of each degree from 11 volts up to 20 volts. From the products of I_f and E_f the corresponding W_f's of the cathode were determined. For the nine degrees of heating voltage (from 11 up to 20 volts), at the anode voltage of 1,500 volts, the corresponding values of the anode current, up to 20 amperes, were checked. The value of the anode current equaled the value of the emission of the cathode.

(2) Three different values of anode current (I_a) and corresponding anode voltage (E_a) were checked, from which the average internal resistance (R_i) was determined.

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(3) From time to time the CAR 6 tube was also tested in the main rectifier equipped with CAR 6.

16. Testing of mercury rectifiers also varied.

a. Diodes (GU 14 and GU 11) were tested as follows:

(1) Six units of GU 14 and five units of GU 11 were set into the testing equipment mentioned above /paragraph 9/. Resistors were connected in the anode circuit.

(2) Low voltage (220 volts) was conducted through resistors to the anode from a transformer, so that the prescribed current flowed through the tube. This was the so-called test on current.

(3) Simultaneously, high voltage (small current) was conducted to the anode from another transformer. This voltage was gradually increased up to the maximum prescribed value. This maximum value was about 50% higher for GU 14 and about 20% higher for GU 11 than the inversion voltage prescribed for the tube. This was the testing on inversion voltage. The high voltage conducted to the tube was switched on and off quickly and at maximum prescribed values in order to check whether the inversion voltage was sinking or not and whether ion inversion charges occurred or not. This testing on anode current and inversion voltage lasted two-thirds of the period needed for the complete testing of these tubes.

(4) While the tube was tested on current and on inversion voltage, the oxide cathode was sintered.

b. Mercury rectifiers with grid (thyratrons) (GT 14 and GT 15) were tested in the testing equipment mentioned above /paragraph 8/. The test of thyratrons was similar to that of diodes with the exception that the thyratrons were first tested in one testing position connected as diodes and then in another position connected as thyratrons, both at the prescribed values of current and inversion voltage. The testing period was twice as long as for diodes.

17. Low-power special tubes were tested in different ways.

a. Tubes with one or more grids were tested as follows:

(1) The testing on cathode heating and anode dissipation was similar to that applied to the transmitter tubes /paragraph 14. a. and b./.

(2) The anode current, anode voltage, and grid bias voltage were checked at several values to determine internal resistance and amplification factor.

(3) Cathode emission was checked indirectly: at the prescribed anode voltage, with either disconnected grid or with the same grid voltage as anode voltage, the emission current was adjusted to the prescribed value by the necessary heater voltage, which was then measured to within an accuracy of 0.1 volt. The checked heater voltage gave the emission.

(4) RD 200/3.5 was also tested in the short-wave diathermic apparatus /paragraph 12/.

b. CU 6 (Diode) tubes were checked according to the following:

(1) The testing on the cathode heating was similar to that described above /paragraph 14. a./.

(2) At the prescribed cathode heater voltage, the prescribed anode current [redacted] 200 m A) was adjusted by the anode voltage. The current was kept at the same value for about 10 minutes. The anode voltage was checked at the beginning and end. The checked values of anode voltage and their differences gave the quality of the vacuum. This testing was repeated under a lower anode current, [redacted] at 150 m A.

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(3) The emission of the cathode was checked indirectly as described above /paragraph 17. a./. The internal resistance was determined from the value of anode current and from the values of anode voltage as established when testing the tube on anode dissipation, as mentioned above.

c. RHT 1 and RHT 2 diodes were checked:

(1) The tube was heated (at about 1.9 volts), the anode voltage was adjusted at 200 volts while the anode current, flowing through the tube, was adjusted at 20 m A by the necessary heating voltage. This testing lasted for about 15 minutes and the heating voltage was checked at the beginning and at the end of the test.

18. The average testing period for tubes is given below:

ACM 1S	2 hours 30 minutes
ACM 3	not established
ACR 2	2 hours 30 minutes
ACS 2	4 hours
ACT 9	3 hours
ACT 14	not established
ACT 16	3 hours 30 minutes
ACT 201	not established
CAM 3	3 hours
CAT 3	3 hours 30 minutes
CAT 6	3 hours 30 minutes
CAT 6K	3 hours 30 minutes
CAT 9	4 hours
CAT 10	4 hours 30 minutes
CAT 12A	3 hours 30 minutes
CAT 14C	5 hours
CAT 17C	5 hours
CAT 20	4 hours 30 minutes
CAT 201	4 hours 30 minutes

CAR 2	30 minutes
CAR 4	30 minutes
CAR 6	30 minutes (period for testing in rectifier not included)
CU 6	30 minutes
DEM 2	5 hours
DET 2	5 hours
DET 3	6 hours
DET 5	45 minutes
DET 11	1 hour
GU 11	2 hours 30 minutes
GU 14	2 hours
GT 14	4 hours
GT 15	8 hours
MR 4	1 hour 30 minutes
MR 6	1 hour 45 minutes
MR 7A	2 hours
MT 9	4 hours
MT 9A	4 hours
MT 9F	4 hours
MT 9L	6 hours
MT 12	4 hours
MT 12A	4 hours
MT 14	6 hours
PT 6B	1 hour 30 minutes
RD 200/3.5	1 hour 15 minutes
RHT 1	30 minutes
RHT 2	30 minutes

19. After the testing of the tube was finished, a record of the testing was prepared which included:

a. Tube designations.

b. Serial number of the tube.

c. Heating voltage (E_f) prescribed, along with corresponding heater current (I_f) as checked.

 [redacted]

d. Emission: voltage and current for anode and grid as prescribed (E_a plus E_g, I_a plus I_g), along with heater voltage as checked.

e. Anode dissipation: anode voltage and current as prescribed, grid bias voltage ($-E_g$), and grid bias (reverse) ($-I_g$) current as checked, or the total period needed for testing the tube on anode dissipation.

Oscillation: anode voltage, anode current and grid current prescribed (anode dissipation, when repeated, same as given above).

"Characteristic": anode current as selected, grid bias voltage as selected, anode voltage as checked, amplification factor as determined, and internal resistance as determined.

f. For transmitter tubes of the largest size the checked values as described above /paragraph 14. h./ were also entered.

g. Date of recording.

20. The tested tubes were transferred to storage once a week, usually on Saturday. High-power transmitter tubes were stored on stands with the top and bottom of the anode attached to the stands. Medium-power transmitter tubes, rectifier tubes, and special tubes were stored on shelves with openings for inserting the tubes. Low-power special tubes were stored in special cartons.

Shipment of Tubes

21. Prior to the shipping of the tubes the integrity of the cathodes and the vacuum were checked. This was done for medium-power tubes, for low-power special tubes, as well as for high-power transmitter tubes of the smallest size; ohm-meter was used for cathode, and inductor for the vacuum. The high-power transmitter tubes of medium and large size were submitted to Pirani tests. While the prescribed current flowed through the tube, the voltage was checked every five minutes. The heating voltage, after 15 minutes of testing, had to remain within the limits which had been ascertained from experience. If the heating voltage were above the limits, the cathode broke or cracked. If the heating voltage was below the limits, the vacuum had deteriorated. In the spring of 1953 it was being considered that all tubes should be submitted to the Pirani test prior to transferring them to storage. [redacted]

22. The high-power transmitter tubes, except those of smallest size, were shipped in special wooden crates. The design of the suspension pack inside the crates was defective and caused a high percentage of rejects. [19] This type of packing was the result of a worker's "improvement suggestion." [20] Medium-power tubes as well as high-power transmitter tubes of smallest size were shipped individually in cardboard cartons, suspended inside the carton in a linen pack. The low-power special tubes were shipped in corrugated cardboard cartons with compartments for each tube.

[redacted]

 [redacted] 25X1

[redacted] 25X1

20. [redacted] Comment: Rude Pravo, 28 March 1954, published an article which stated that new crates for packing electronic tubes were designed. The article did not mention the plant concerned. [redacted] the Tesla-Vrsovice Plant was the one in question and these crates were not of new design but a slightly modified old design which had been known prior to the "improvement suggestion" mentioned above and which had been in the process of development since the second half of 1952. 25X1 25X1